OPERATING METHOD FOR A PACKAGING MACHINE OF THE SLEEVE TYPE, PACKAGING MACHINE FOR IMPLEMENTING THE SAID METHOD, AND PACKAGE PRODUCED BY THE SAID METHOD

SUBSTITUTE SPECIFICATION

FIELD OF THE INVENTION

The present invention relates to an operating method for a packaging machine of the "sleeve" type, a packaging machine for implementing the said method, and a package produced by the said method.

BACKGROUND OF THE INVENTION

At the present time - see for example US Patent 5,203,144 - sheets of sheet material are fed to the wrapping means by a feed system comprising three operating members and various devices and, more particularly, from the upstream to the downstream end, sheet feed means, a first sheet conveyor and a second sheet conveyor, in which the said sheet feed means feed the sheets towards and on to the first sheet conveyor, in which the said two sheet conveyors are placed in sequence with respect to the direction of feed of the sheets, in which by means of the said various devices the first sheet conveyor, located upstream, is driven at a constant speed and the second sheet conveyor, located downstream, is driven at variable speed.

This known system carries out the function of feeding the sheets to the wrapper means very successfully, but gives rise to various problems.

A first problem is due to the fact that the system comprises a multiplicity of components, with consequent high production, maintenance and running costs.

A second problem is due to the fact that two phases of transfer are provided for each sheet, namely a first phase in which the sheet is transferred from the feed means to the first sheet conveyor and a second phase in which the sheet is transferred from the said first sheet conveyor to the said second sheet conveyor. with consequent possible errors of misalignment of the longitudinal position of the sheet during the said transfers, in which the summation of two possible transfer errors could bring about an incorrect positioning of the sheet (in other words leading or lagging) with respect to the machine cycle of the advance of the objects and/or of the wrapping bars.

OBJECT OF THE INVENTION

The object of the present invention is therefore to resolve the aforesaid problems.

SUMMARY OF THE INVENTION

The invention, which is characterized by the claims, resolves the problem of creating an operating method for a packaging machine of the "sleeve" type, which wraps sheets of packaging material around objects, in which the said machine comprises first object conveyor means, for feeding the objects longitudinally in sequence with spaces between them; second object conveyor means, located downstream and at a small distance from the said first object conveyor means, forming a first opening between the said first and the said second object conveyor means for receiving the objects arriving from the said first object conveyor means and for moving the said objects along a wrapping plane which has an entry end and an exit end; third object conveyor means, located downstream and at a small distance from the said second object conveyor means, forming a second opening between the said second and the said third object conveyor means, for receiving the objects arriving from the said second object conveyor means; sheet wrapping means, located in the proximity of the said second object conveyor means, comprising at least one suspended wrapping bar which is orientated transversely with respect to the direction of advance of the objects, and is caused to move through the said first and the said second aperture along an orbital path which circumscribes the top of the said second object conveyor means, and capable of transporting the sheets of packaging material;

sheet conveyor means of the conveyor belt type, located underneath and aligned with the said first opening and in proximity thereto, for feeding the sheets of packaging material in the proximity of the said first opening; and synchronizing means for synchronizing the said operating means with each other, in which the said method is characterized in that the sheets of packaging material are fed along the said sheet conveyor of the conveyor belt type in a configuration having a accumulated portion of material and in that the said wrapping bar collects the said accumulated portion of material in the proximity of the said first opening and then carries out the phase of transport of the sheet.

The invention, which is characterized by the claims, also resolves the problem of creating a packaging machine of the "sleeve" type for implementing the aforesaid method, and also a package produced by the said method.

The use of a method and machine of this type yields the following results: the packaging operations are simplified, the operations of transferring the sheets are reduced, the two sheet conveyors arranged in series one after the other for feeding the sheets to the wrapping means are not required, and the devices for driving the said two sheet conveyors are not required.

The advantages obtained by means of the present invention consist, principally, in an improvement of the packaging operations and in a reduction of the production, maintenance and running costs of the corresponding machine.

BRIEF DESCRIPTION OF THE DRAWING

Further characteristics and advantages of the present invention will be made clearer by the following description of a preferred example of embodiment thereof, given here purely by way of example and without restrictive intent, with reference to the attached drawing, in which:

FIG. 1 is a schematic illustration of the system according to the present invention, incorporated in a packaging machine;

FIGS. 2, 3, 4, 5, 6 and 7 illustrate operating sequences according to the method and system according to the present invention;

FIG. 8 illustrates a different form of the method according to the present invention; and

Fig. 9 illustrates a different form of the method according to the present invention.

SPECIFIC DESCRIPTION

FIG. 1 shows an automatic packaging machine of the "sleeve" type, for wrapping individually and in succession the objects 1 by means of sheets 2 of wrapping material. The objects 1 can be single units or groups of bottles or other kinds of object. The sheets 2 can be sheets of heat-shrinking polyethylene or the like, in which, essentially, the sheets 2 are wrapped in the form of sleeves around the objects 1. After

wrapping the object and sheet assembly 1-2 produced in this way is heat-shrunk, if required, in a heat-shrinking oven 3.

The said system essentially comprises first object conveyor means 10, second object conveyor means 20, third object conveyor means 30, sheet wrapping means 40, sheet conveyor means 50, sheet feed means 60 and synchronizing means 70.

With reference to Figure 1, the said three object conveyor means 10, 20, 30 comprise three conveyors of the conveyor belt type, the belts being indicated by 11, 21 and 31 30 respectively. which are arranged in series one after the other and spaced apart by small gaps longitudinally, in order to form a first opening, A1, between conveyors 10 and 20, and a second opening, A2, between conveyors 20 and 30.

A servo motor MI, preferably of the speed and phase control type, such as a brushless motor with a servo control system, drives the three conveyors 10, 20 and 30, by directly driving a roller shaft 22 of the second object conveyor 20, at the opposite ends of which there are keyed gears 23 and 24, on which run the chains 25 and 26 respectively, in which the first chain 25 also runs around a gear 12 keyed on a roller shaft 13 which drives the first object conveyor 10 and the second chain 26 also runs around a gear 32 keyed on a roller shaft 33 which drives the third object conveyor
10 30.

The motor M1, for reasons which will be made clear subsequently, is connected to and controlled by the synchronizing

means 70, which can comprise a programmable control unit 71 such as a PLC and/or a computer and/or other device, programmable by means of a keyboard 72 and provided with a corresponding display unit 73.

The second object conveyor 20 interacts with the sheet wrapper means 40, comprising at least one transverse wrapping bar 41 which orbits around the said second object conveyor 20, passing through the said first opening A1 and the said second opening A2, in which the said bar 41 has its opposite ends supported by two corresponding chains 42a and 42b, which run around corresponding gears.

The chains 42a and 42b are driven by a first pair of sprockets 44a and 44b, keyed on the ends of a single shaft 45, which in turn is driven by a servo motor M2, preferably of the speed and phase control type, such as a brushless motor with a servo control system, which is also connected to the synchronizing means 70.

In the area underneath the object conveyor 20, in the proximity of its entry end, there are positioned the sheet conveyor means 50, which comprise a conveyor having a conveyor belt 51, the latter being preferably of the suction type, for gripping the sheets in succession, in which the said sheet conveyor means 50 are driven by a servo motor M3, preferably of the speed and phase control type, such as a brushless motor with a servo control system, which is also connected to the synchronizing means 70 and which drives a roller shaft 52.

-In the proximity of the upstream portion of the sheet conveyor means 50 there are positioned the sheet feeder means 60, which, from the upstream to the downstream end, comprise a first pair of transfer rollers 61 and 62 for extracting a continuous strip 3 from a reel which is not illustrated, a rotating cutter 63, for cutting the continuous strip 3 when so commanded, and a second pair of transfer rollers 64 and 65, for feeding the strip 3 and, after cutting, the sheets 2 towards and on to the suction belt 51 of the sheet conveyor means 50.

The two pairs of transfer rollers 61-62 and 64-65 are driven by a servo motor M4, preferably of the speed and phase control type, such as a brushless motor with a servo control system, which is also connected to the synchronizing means 70, and the rotating cutter 63 is driven by a servo control unit M5, also connected to the synchronizing means 70.

Optionally, depending on the type of packaging material used and/or the length of the sheet to be formed and/or the amplitude of the wave which is to be obtained, as explained more fully below, it is possible to provide guides 66 and 67, which are preferably extendable, for guiding the strip and sheet 3-2 during its travel towards the suction belt 51, and, again optionally, the said sheet feeder means 60 can also be made to oscillate angularly with respect to an axis 68 parallel to the plane of movement of the sheets formed by the suction belt 51, in order to be able to vary (see Fig. 2) the angle (3 of

incidence between the sheet feed plane 2 of the sheet feeder means 60 and the sheet conveying plane defined by the active run of the suction belt 51 of the sheet conveyor 20 means 50 and, in this context, to fix, for example by means of a graduated bar 69 and clamps, the said sheet feeder means in an optimal angular position so that the extendable guides 66 and 67 can then be adjusted, and also to provide an outer casing 60a for the said sheet feeder means 60, in order to avoid contact between the material forming the packaging accumulated portion of material 2b and the operating elements 61-62-63-64-65 of the said sheet feeder means 60, in order to optimize the operation of the system according to the present invention, as will be explained more fully below.

Upstream of the said sheet feeder means 60 there are positioned means for controlling the unwinding of the reel of continuous packaging strip, which are not described or illustrated here since they lie outside the scope of the present invention.

In the first place, with reference to the description, the figures and the claims, it should be emphasized that, primarily but not essentially, one of the characteristics of the present invention consists in the fact that the sheet 2 of packaging material is moved by the sheet conveyor means 50 towards the sheet wrapping means 40 in a configuration which produces an accumulated portion 2b of material (in a loop as shown and not in a flat way as in the known art), in which the

said accumulated portion 2b (see Fig. 2) makes it possible to obtain along a segment LI of the conveying run of the suction belt 51 a length of packaging material which is much greater than the said length LI. The accumulated portion 2b can be in a loop of the undulating type with a single peak (crest) as shown in the said Fig. 2, or of the undulating type with multiple peaks (crests) 2b'-2b", as shown in Fig. 8, or of the gathered undulating type 2bz as shown in Fig. 9, or of another type, without departure from the inventive concepts protected by the present invention.

The accumulated portion 2b (Fig. 2), or 2b'-2b" (Fig. 8), or 2bz (Fig. 9) of packaging material above and along the suction belt 51 can be formed by means of various embodiments of the invention.

In a first embodiment, in order to produce along the conveying run of the suction belt 51 a sheet 2 having an accumulated portion 2b which is undulating with a single peak (see Fig. 2), in other words a sheet 2 in the form of an "Ω" with horizontal (flat) projections 2a and 2c spread out and gripped by the said suction belt 51, during the phase of feeding the strip and sheet 3-2 on to and towards the suction belt 51, by means of the motors M3 and M4, a first phase is provided in which the feeding speed of the sheet feeder means 60 is equal to the transport speed of the sheet conveyor means 50, thus producing on the belt 51 a first portion 2a spread out on the said belt 51, and then a second phase, in which the said sheet conveyor means

50 are stopped temporarily while the sheet feeder means 60 are kept in motion, thus forming a second undulating accumulated portion 2b of material, and a third phase, in which the feeding speed of the sheet feeder means 60 is equal to the transport speed of the sheet conveyor means 50, thus forming on the belt 51 a third portion, 2c, spread out on the said belt 51.

In a second embodiment, in order to produce along the conveying run of the suction belt 51 a sheet 2 having an undulating accumulated portion 2b'-2b" with two or more peaks (crests) (see Fig. 8), in other words a sheet 2 arranged in the form of "ΩΩ", "ΩΩΩ" , etc., by means of the motors M3 and M4, the aforesaid second and third phases are repeated one or more times.

In a third embodiment, in order to produce along the conveying run of the suction belt 51 a sheet 2 having an accumulated portion 2b which is undulating with a single peak (see Fig. 2), in other words a sheet 2 in the form of an "Ω" with horizontal (flat) projections 2a and 2c spread out and gripped by the said suction belt 51, during the phase of feeding the strip and sheet 3-2 on to and towards the suction belt 51, by means of the motors M3 and M4, a first phase is provided in which the feeding speed of the sheet feeder means 60 is equal to the transport speed of the sheet conveyor means 50, thus producing on the belt 51 a first portion 2a spread out on the said belt 51, and then a second phase, in which the sheet conveyor means 60 are driven with a feeding speed of the strip and sheet 3-2 greater

than the pick-up speed of the belt 51 of the sheet conveyor means 50, thus forming a second undulating accumulated portion 2b of material with a single peak, and a third phase, in which the feeding speed of the sheet feeder means 60 is equal to the transport speed of the sheet conveyor means 50, thus forming on the belt 51 a third portion, 2c, spread out on the said belt 51.

In a fourth embodiment, in order to produce along the conveying run of the suction belt 51 a sheet 2 having an undulating accumulated portion 2b'-2b" with two or more peaks (see Fig. 8), in other words a sheet arranged in the form of "ΩΩ", "ΩΩΩ", etc., by means of the motors M3 and M4, the aforesaid second and third phases are repeated one or more times.

In a fifth embodiment, in order to produce along the conveying run of the suction belt 51 a sheet 2 having a gathered accumulated portion 2bz (see Fig. 9), during the phase of feeding the strip and sheet 3-2 on to and towards the suction belt 51, by means of the motors M3 and M4, a first phase is provided, in which the feeding speed of the sheet feeder means 60 is equal to the transport speed of the sheet conveyor means 50, thus producing on the belt 51 a first portion 2a which is spread out on the said belt 51, then a second phase in which the sheet conveyor means 60 are driven at a feeding speed of the strip and sheet 3-2 which is greater than the pick-up speed of the belt 51 of the sheet conveyor means 50, thus forming a second, gathered, accumulated portion of material 2bz, in which the shape of the

gathering is subject to and determined by the chosen operating speed and/or the angle of incidence R between the sheet feed plane 2 and the sheet conveying plane and/or the thickness, weight, and bending resistance of the 30 packaging material used.

With reference to Figures 2 to 8, a description will now be given of an operating method for the packaging machine described above, in which the sheets 2 of packaging material are fed along the said sheet conveyor 50 in a configuration having an accumulated portion 2b of material with a single peak in the form of an "Ω", although, clearly, the said method is applicable in an identical way by using sheets having their accumulated portions configured according to one of the aforesaid variants, with two or more peaks 2b'-2b", in a gathered shape 2bz, or in another form, without departure from the inventive concepts indicated and protected herein.

With reference to the aforesaid figures, the objects 1 are transported in succession, singly and spaced apart, from the upstream to the downstream end, preferably with a continuous motion, being transported longitudinally along the three object conveyors 10,20 and 30.

At a lower level, the sheets 2 of packaging material, in the aforesaid configuration in which an undulating accumulated portion 2a of material is provided, are progressively formed and transported by means of the suction belt 51 of the sheet conveyor means 50 towards the opening A1, and one or more orbiting bars 41

of the wrapping means 40 are made to move along their wrapping path.

With reference to Figure 2, when an object 1, during its longitudinal advance, straddles the first object conveyor 10 and the second object conveyor 20, the sheet conveyor 50 transports downstream a sheet 2 having the undulating accumulated portion 2b of material, in such a way as to position the front portion 2a of the said sheet 2 at the entry end of the second object conveyor 20 in synchronization with the arrival of the object 1.

With reference to Figure 3, the object conveyor means 20 and the sheet conveyor means 50 have been driven preferably at the same speed, and therefore the front portion 2a of the sheet 2 has been placed correctly between the base of the object 1 and the transport plane of the second object conveyor 20.

With reference to Figure 4, when the rear end of the object 1 has passed beyond the said first opening A1 and the accumulated portion 2b of material has reached the proximity of the said first opening A1, the wrapping bar 41 encounters the accumulated portion 2b of material, and, during the next phase (see Fig. 5), in which the wrapping bar 41 draws the sheet 2 over the object 1 in a downstream direction, the said undulating accumulated portion of material 2b is used, thus overcoming the aforesaid drawbacks of the known art which required two sheet conveyors in series and in which the transport speed of the second sheet conveyor had to be increased during the said phase.

Preferably, but not exclusively, it is best to provide a phase relationship between the said sheet conveyor means 50 and the said sheet wrapping means 40 in which, essentially, when the initial part of the said accumulated portion of material 2b reaches the proximity of the said first opening A1, the wrapping bar 41 of the wrapping means 40 passes upwards through the said first opening A1, in order to initiate immediately the phase of transport of the sheet 2.

With reference to Figure 6, the speed of advance of the wrapping bar 41 is such that it is brought beyond the object 1 and downwards to a position below the transport plane of the conveyors 20 and 30, being made to pass through the second opening A2, before the object 1 reaches the said second aperture A2, in order to position the terminal part of the sheet 2 so that it hangs between the said second conveyor 20 and the said third conveyor 30.

Finally (see Fig. 7), the object 1 is transported by the second conveyor 20 on to the third conveyor 30, the terminal part of the sheet 2 being positioned under the object I and under the initial part 2a of the said sheet 2.

With reference to the above description, in the case in which the said objects I comprise groups of bottles or the like, in order to optimize the packaging cycle while avoiding the tipping of the said bottles due to their acceleration and/or deceleration, it is preferable to provide a constant speed drive for the three object conveyor means 10-20-30, in order to

transport the groups 1 with a continuous unidirectional motion from the upstream to the downstream end, and accordingly to provide a variable speed drive for the sheet wrapping means 40 and for the sheet conveyor means 50, in order to obtain the desired phase relationships for the implementation of the aforesaid phases of operation.

With reference to the above description, in order to optimize the unwinding of the reel of packaging material while avoiding the acceleration and/or deceleration of the reel and/or the use of "buffer" devices for the packaging material placed between the said reel and the sheet feeder means 60, it is preferable to provide a constant speed drive for the sheet feeder means 60 and therefore to drive the sheet conveyor means 50 with a variable motion, in order to obtain the desired phase relationships for the implementation of the aforesaid phases of operation.

The above description of the operating method and of the machine are provided solely by way of example and without restrictive intent, and it is therefore clearly possible to modify and/or vary these in ways suggested by practice and their use or application within the scope of the following claims, in which the latter form an integral part of the above description.